K* reconstructed in pp reactions at 3.5 GeV*

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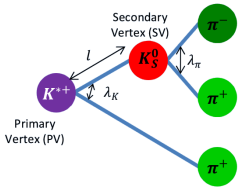
The investigation of $K^{*+}(892)$ production in 3.5 GeV $p+p$ reaction is of great interest, due to the lack of experimental data at energies near to the production threshold [1, 2]. In addition, the available $p+Nb$ data will allow us to study the in-medium modifications of the $K^{*+}(892)$ in the future by using the results obtained from the current analysis as a reference. The production of $K^{*+}(892)$ can be easily studied by reconstructing it from its decay into a neutral kaon and a charged pion (Fig. 1). Thus we performed the analysis of the $K^{*+}(892)$ production in $p+p$ collisions at 3.5 GeV.

Figure 1: The short-lived K^{*+} decays at the primary vertex into a K^0_S and a π^+. The K^0_S decays into a pair of charged pions after a short time.



The reconstruction of the $K^{*+}(892)$ can be summarized as follows: (i) Following the scheme shown in Figure 1 and applying appropriate topological cuts, the $K^0_S\pi^+$ pairs are reconstructed; (ii) the invariant mass spectrum of the $K^0_S\pi^+$ pairs is fitted with a modified Breit-Wigner function, taking into account the background, phase space limitations and detector resolution. This allows to extract the yield of the $K^{*+}(892)$. The total yield is well above 1000 K^*s, which gives the opportunity to perform a single differential analysis by dividing the data into five transverse momentum bins; (iii) Assuming uniform phase space distribution, we simulate the two dominant $K^{*+}(892)$ production channels using the PLUTO event generator: $p+p \rightarrow p+K^{*+}+\Lambda^0$ and $p+p \rightarrow p+K^{*+}+\Sigma^0$. Then the response of the detector is simulated using HGeant. The result is analyzed in the same way as the experimental data. Thus, as the acceptance and efficiency correction factor for the experimental data, we can use the ratio between the number of reconstructed K^*s after HGeant and the number of K^*s generated in PLUTO. Due to the small difference in the correction factor between the two simulated channels we use only the Λ associated production channel for the correction of the data; (iv) by normalizing the K^* yield to the elastic pp scattering cross section observed in this experiment, we can find the differential cross section for each p_T bin. The integration of the spectrum delivers the total K^* production cross section; (v) It is possible to investigate the

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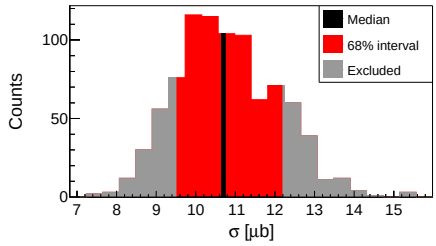

Figure 2: Systematic result for the $K^{*+}(892)$ total production cross section. Any topological cuts that did not produce meaningful result (e.g. the fit of the IM spectrum did not converge) were excluded.

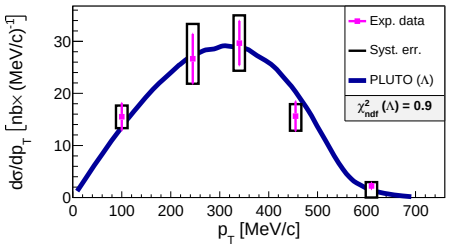

Figure 3: Differential production cross section of the $K^{*+}(892)$ as a function of p_T.

data for spin-alignment effects. This was performed and no hint for such effects was present within uncertainties.

In order to investigate the stability of the reconstruction procedure and to obtain information on its systematic error, this analysis was performed over 1200 different cut combinations. The distribution of the results for the total $K^{*+}(892)$ production cross section resulting from those iterations is shown in Figure 2. The final cross section was obtained by taking the median of this distribution, the systematic error was obtained by taking the 68% central interval, and the statistical error was taken as the average statistical error over all topological cuts. As shown in Figure 3 the obtained distribution of the differential cross section in p_T is in a good agreement with the prediction of pure Λ associated production of the $K^{*+}(892)$. Because of the relatively large error it is difficult to evaluate the yield resulting from the Σ associated production channel.

References

[1] Baldini *et al.*, "Numerical Data and Functional Relationships in Science and Technology", Springer, Volume 12b, 1988.

[2] Bockmann *et al.*, "Inclusive K*+(892) production in pp and π^+p interactions", Nucl. Phys. B 166 (1980) 284.

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